CLAIMS:

1. A fluid measurement system comprising an imaging means for taking images of particles contained in a fluid to be measured at small time intervals, and an image processing means for comparing luminance pattern distributions at a plurality of consecutive time points obtained by said imaging means to measure a moving direction and a moving amount of a particle group, and analyzing a flow field of the fluid to be measured,

said imaging means comprising a long focus optical system being of a long distance type capable of imaging a fluid to be measured a long distance away, and

said system comprising a turbulence structure extraction means for extracting a turbulence structure of the fluid to be measured from the particle images obtained by said imaging means, wherein said image processing means measures a moving direction and a moving amount of the extracted turbulence structure to analyze the flow field of the fluid to be measured.

2. The fluid measurement system according to claim 1, wherein

said turbulence structure extraction means comprises a spatial frequency transformation means for transforming the image taken by said imaging means to spatial frequency components of luminance, a high-pass filter for leaving high frequency components at a predetermined frequency and higher from the transformed frequency components, and an image transformation means for transforming the frequency components after the filtering processing by said high-pass filter to an image.

3. The fluid measurement system according to claim 2, wherein

said turbulent extraction means further has means for applying a

window function to a signal of the image taken by said imaging means.

4. The fluid measurement system according to claim 3, wherein

Blackman window is used as the window function.

5. The fluid measurement system according to any one of claim 1 to claim 4, further comprising:

a difference calculation means for obtaining, from the luminance pattern distributions at the plurality of consecutive time points obtained by said imaging means, a difference between the luminance pattern distributions at the plurality of consecutive time points as a difference luminance pattern distribution,

wherein said image processing means analyzes the flow field of the fluid to be measured using the difference luminance pattern distributions at a plurality of consecutive time points obtained by said difference calculation means.

6. The fluid measurement system according to claim 1, wherein

said imaging means is of a long distance type capable of imaging a luminance pattern distribution by natural light reflection in the fluid to be measured a long distance away.

7. The fluid measurement system according to claim 1, further comprising:

a laser light input means for inputting a laser light in a sheet form into the fluid to be measured,

wherein said imaging means is of a long distance type capable of imaging a luminance pattern distribution by the laser light reflection in the fluid to be measured a long distance away.

8. The fluid measurement system according to any one of claim 1 to

claim 7, wherein

said imaging means is of a long distance type capable of imaging the fluid to be measured 10 m or greater and 20 km or less away from the set position of said imaging means.

9. A fluid measurement method, comprising the steps of:

taking images of particles contained in a fluid to be measured a long distance away at small time intervals by an imaging means comprising a long focus optical system,

comparing luminance pattern distributions of particle images at a plurality of consecutive time points obtained by the imaging means to measure a moving direction and a moving amount of a particle group; and

analyzing a flow field of the fluid to be measured from the moving direction and the moving amount of the particle group,

said method comprising the step of extracting a turbulence structure of the fluid to be measured and measuring the moving direction and the moving amount of the extracted turbulence structure to analyze the flow field of the fluid to be measured, when the number of particles contained in one pixel of the particle image obtained by the imaging means is plural.

10. The fluid measurement method according to claim 9, wherein

said step of extracting a turbulence structure of the fluid to be measured comprises the steps of transforming the image taken by the imaging means to spatial frequency components of luminance, performing filtering processing to leave high frequency components at a predetermined frequency and higher from the transformed frequency components, and transforming the frequency components after the filtering processing to an image.

11. The fluid measurement method according to claim 10, wherein

said step of extracting a turbulence structure of the fluid to be measured further comprises the step of applying a window function to a signal of the image taken by said imaging means.

12. The fluid measurement method according to any one of claim 9 to claim 11, further comprising the step of:

imaging a luminance pattern distribution by natural light reflection in the fluid to be measured, and analyzing the flow field of the fluid to be measured.

13. The fluid measurement method according to any one of claim 9 to claim 12, further comprising the steps of:

inputting a laser light in a sheet form into the fluid to be measured, imaging a luminance pattern distribution by the laser light reflection in the fluid to be measured, and analyzing the flow field of the fluid to be measured.

14. The fluid measurement method according to any one of claim 9 to claim 13, further comprising the steps of:

imaging the fluid to be measured 10 m or greater and 20 km or less away from the set position of the imaging means, and analyzing the flow field of the fluid to be measured.

15. The fluid measurement method according to any one of claim 9 to claim 14, further comprising the step of:

analyzing the flow field of smoke, volcanic ash, water vapor, yellow sand, crowd, pollen or air 10 m or greater and 20 km or less away from the set position of the imaging means, as the fluid to be measured.